Day 118 **B Tier 10-a-day: Model Solutions**

1 Substitution into formulae

Here is a formula.
T = 5n + 20
Work out the value of T when n = 2

T = 5 × 2 + 20
T = 30
Answer: T = 30

2 Faces, edges and vertices

Write down the number of edges and vertices of a hexagonal-based pyramid.

Edges: 6 on the base plus 6 up to the point = 12
Vertices: 6 on the base plus the top point = 7
Answer: edges: 12 vertices: 7

3 Forming expressions

Jo has x stickers.
Ben has 6 more stickers than Jo.
Cara has 4 times as many stickers as Jo.
(a) Write an expression, in terms of x, for the number of stickers Ben has.
(b) Write an expression, in terms of x, for the total number of stickers the three of them have. Give your answer in its simplest form.

(a) Ben has 6 more than Jo: x + 6
(b) Cara has 4x
Total = x + (x + 6) + 4x
Collect like terms: 6x + 6
Answer: (a) x + 6 (b) 6x + 6

4 Rates

Electricity costs 15p per unit.
There is also a standing charge of £8.
Work out the total bill for 420 units.

Cost of units: 420 × 15p = 6300p = £63
Add the standing charge: £63 + £8 = £71
Answer: £71

5 Standard form

Write each number as an ordinary number.
(a) 8.9×10^{6}
(b) 5×10^{-3}

(a) Multiply by 10, 6 times: move the decimal point 6 places right
$8.9 \times 10^{6} = 8{,}900{,}000$
(b) $10^{-3} = 0.001$, so move the decimal point 3 places left
$5 \times 10^{-3} = 0.005$
Answer: (a) 8,900,000 (b) 0.005

6 Sample space of two dice

Two fair dice, numbered 1 to 5 and 1 to 6, are rolled.
Work out the probability that the total score is 8.

There are 5 × 6 = 30 equally likely outcomes
Ways to make 8: (2,6), (3,5), (4,4), (5,3)
P = 4 out of 30
Answer: $\frac{2}{15}$

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7 Compound percentages

Mohammed invests £1200 in a savings account. (Calculator)
The account pays 6% compound interest per year.
Work out the amount in the account after 3 years.
Give your answer to the nearest penny.

Multiplier = 1 + 6% = 1.06

Amount = 1200×1.06^3
= £1429.22

Answer: £1429.22

8 Counting outcomes

A 4-digit code is made using only the digits 1, 3, 5, 7, 9.
A digit can be used more than once.
How many different codes are possible?

Each digit has 5 choices
$5 \times 5 \times 5 \times 5 = 625$

Answer: 625

9 Quadratic equation problem

A rectangle has length (x + 5) cm and width (x − 6) cm.
The area of the rectangle is 42 cm^2.
(a) Show that $x^2 - x - 72 = 0$
(b) Hence work out the length of the rectangle.

(a) Area = length × width: $(x + 5)(x - 6) = 42$

Expand: $x^2 - x - 30 = 42$

Subtract 42 from both sides: $x^2 - x - 72 = 0$

(b) Factorise: $(x - 9)(x + 8) = 0$, so $x = 9$ or $x = -8$

A length cannot be negative, so x = 9. Length = 9 + 5 = 14

Answer: (b) 14 cm

10 Column vectors

$\mathbf{a} = \begin{pmatrix} 5 \\ 7 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$

Work out
(a) $2\mathbf{a} + \mathbf{b}$
(b) $3\mathbf{a} + 2\mathbf{b}$

(a) $\begin{pmatrix} 10 \\ 14 \end{pmatrix} + \begin{pmatrix} 2 \\ -1 \end{pmatrix} = \begin{pmatrix} 12 \\ 13 \end{pmatrix}$

(b) $\begin{pmatrix} 15 \\ 21 \end{pmatrix} + \begin{pmatrix} 4 \\ -2 \end{pmatrix} = \begin{pmatrix} 19 \\ 19 \end{pmatrix}$

Answer: (a) $\begin{pmatrix} \mathbf{12} \\ \mathbf{13} \end{pmatrix}$ **(b)** $\begin{pmatrix} \mathbf{19} \\ \mathbf{19} \end{pmatrix}$